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# PATENT ABSTRACTS OF JAPAN

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(21)Application number : 11-352934

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IND CO LTD

(22)Date of filing : 13.12.1999

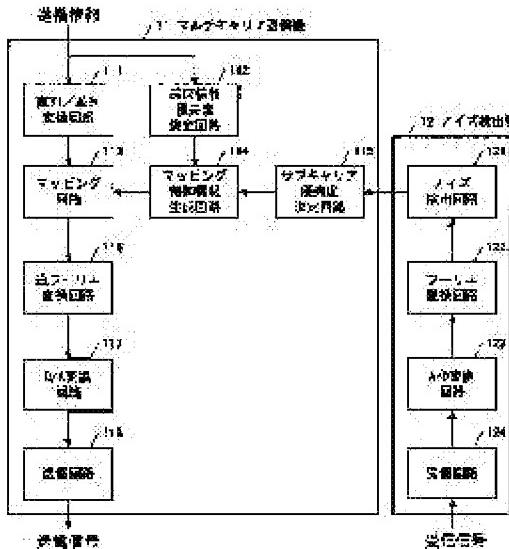
(72)Inventor : OMOTO MASAO  
MAKI MASAHIRO  
KONDO JUNJI  
IGATA YUJI

## (54) MULTI-CARRIER TRANSMITTER AND RECEIVER

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To solve the problem of a conventional multi-carrier transmission system that is allocated with transmission information with high priority to a carrier with a frequency where a high level noise is present.

**SOLUTION:** A noise detector 12 detects noise in a transmission channel, a subcarrier priority decision circuit 115 decides the priority of a subcarrier in use on the basis of the result of detection, and a mapping control information generating circuit 114 gives an instruction to a mapping circuit 113 to cross- reference the subcarrier priority to the priority of transmission information thereby allowing the mapping circuit 113 to change the allocation of carriers.



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## CLAIMS

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[Claim(s)]

[Claim 1]A multi carrier transmitter comprising:

Two or more transmit information which a priority is assigned and is inputted.

A noise information acquisition means which detects a noise level for two or more frequency bands of every from a transmission line.

A multi-carrier signal generating means which said priority assigns transmit information of high order, carries out career generating, and a noise level detected by said noise information acquisition means outputs to a transmission line in order of a low frequency band.

[Claim 2]The multi carrier transmitter according to claim 1 characterized by making it not assign said transmit information to a frequency band where said noise level was detected when judged with said multi-carrier signal generating means having to transmission an unsuitable noise level detected by said noise information acquisition means.

[Claim 3]The multi carrier transmitter according to claim 1 or 2 said multi-carrier signal generating means's assigning mapping information which frequency band to have assigned said two or more transmit information to a frequency band specific, as transmit information, carrying out career generating, and outputting it to a transmission line.

[Claim 4]A multi-carrier signal demodulation means which receives a multi-carrier signal transmitted by the multi carrier transmitter according to claim 3 and to which it restores, A multi carrier receiver extracting said mapping information from said multi-carrier signal demodulation means, and extracting two or more receipt information according to the information.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the multi carrier transmitter and receiver which are one of the information data transmission systems.

[0002]

[Description of the Prior Art]In recent years, in wire communications, such as radio, such as digital sound broadcast and digital television broadcasting, or a pair wire, the multi-carrier transmission method attracts attention. A multi-carrier transmission method transmits by dividing information into two or more careers.

[0003]The example of the conventional multi carrier transmitter is shown in drawing 7. Transmit information is inputted into series / parallel-conversion machine 71 in drawing 7. This series / parallel-conversion machine 71 change input data into parallel data from serial data, and outputs it. The parallel data is inputted into the mapping circuit 72, and performs assignment of a carrier frequency, amplitude, and a phase. Inverse Fourier transform of the data outputted from this mapping circuit 72 is carried out in the inverse

FOURIER transform circuit 73, it changes into analog data from digital data in the D/A conversion circuit 74, and the sending circuit 75 performs frequency conversion.

[0004]The example of the conventional multi carrier receiver is shown in drawing 8. In drawing 8, frequency conversion of the input signal is carried out by the receiving circuit 81. After changing the data into digital data in the A/D conversion circuit 82 and carrying out the Fourier transform by the Fourier conversion circuit 83, it rearranges by the demapping circuit 84, changes into serial data with the parallel/serial-conversion machine 85, and outputs as receipt information.

[0005]In the conventional multi-carrier transmission method, when two or more information was transmitted, information was arranged to the subcarrier decided beforehand. The speech information for using the subcarrier of eight channels and talking between the transmitting side and a receiver in drawing 9, When transmitting control information required in order to transmit and receive, and the file transfer information between computers as transmit information, speech information is transmitted to f3 from the frequency f1 by distributing control information to the frequency f4 and f5, and distributing file transfer information to the career of the channel of f8 from the frequency f6. In this case, control information and speech information are transmit information with a high priority which is not allowed resending of information, even when information is mistaken, and since resending of information is allowed even when information is mistaken, file transfer information is transmit information with a low priority.

[0006]Since the large noise of a level is the frequency f3 and f5 neighborhood supposing a noise like drawing 2 exists in a transmission line at this time, voice \*\*\*\* which uses the frequency f3 becomes there is not less, and a signal quality will deteriorate greatly. In a wire communication, the large noise of the frequency f3 or a level like f5 is a broadcast wave in many cases, it acts on various factors, such as time, the weather, and a place, and the frequency and level are changed.

[0007]

[Problem(s) to be Solved by the Invention]As stated above, when two or more information was transmitted as transmit information, in the conventional multi-carrier transmission method, information was arranged to the subcarrier decided beforehand. Therefore, in the information to transmit, when transmit information with a high priority has been arranged at the career of frequency with a high noise level, the reliability of information will fall. Since a noise level was influenced by the factor of time, the weather, a place, etc. when a transmission line receives the interference from a terrestrial wave, in the multi-carrier transmission which performs career arrangement fixed, the technical problem that it could not respond accommodative to the factor which changes to these usual states occurred.

[0008]The purpose of this invention is to provide the multi carrier transmitter and receiver which can raise the reliability of the information to order with a high priority of transmit information by performing career arrangement according to the priority of transmit information, and the noise level of a transmission line.

[0009]

[Means for Solving the Problem]In order to solve the above-mentioned problem, a characteristic constituent means shown below is used for this invention.

[0010](1) A multi carrier transmitter concerning this invention, Two or more transmit information which a priority is assigned and is inputted, and a noise information

acquisition means which detects a noise level for two or more frequency bands of every from a transmission line, A multi-carrier signal generating means which a priority assigns transmit information of high order, carries out career generating, and a noise level detected by the noise information acquisition means outputs to a transmission line in order of a low frequency band is provided.

[0011]When judged with said multi-carrier signal generating means having to transmission an unsuitable noise level detected by said noise information acquisition means, it is made not to assign said transmit information to a frequency band where said noise level was detected in composition of (2) and (1).

[0012]In composition of (3), (1), and (2), said multi-carrier signal generating means assigns mapping information which frequency band to have assigned said two or more transmit information to a frequency band specific, as transmit information, carries out career generating, and is outputted to a transmission line.

[0013](4) A multi carrier receiver concerning this invention is characterized by getting over by receiving a multi-carrier signal transmitted by a multi carrier transmitter in composition of (3), extracting said mapping information from data to which it restored, and extracting two or more receipt information according to that information.

[0014]

[Embodiment of the Invention]Hereafter, it explains, referring to drawings for an embodiment of the invention. Drawing 1 is a block diagram showing the composition of the multi carrier transmitter which is one embodiment of this invention.

[0015]In the multi carrier transmitter 11, two or more transmit information which includes a priority in information is inputted into the transmit information priority determining circuit 112, and the series/parallel conversion circuit 111. This transmit information priority determining circuit 112 extracts the priority included in transmit information, and the priority of the extracted transmit information is outputted to the mapping control information generating circuit 114. Series / parallel conversion circuit 111 changes input data into parallel data from serial data, and the parallel data is outputted to the mapping circuit 113. The mapping circuit 113 is arranged to the subcarrier to which input data was directed with the mapping indication signal from the mapping control information generating circuit 114, and has a function outputted to the inverse FOURIER transform circuit 116. By carrying out inverse Fourier transform of the data inputted from the mapping circuit 113, the inverse FOURIER transform circuit 116 generates a multi-carrier signal, and outputs it to the D/A conversion circuit 117. The D/A conversion circuit 117 changes into analog data the multi-carrier signal inputted from the inverse FOURIER transform circuit 116 from digital data, and outputs it to the sending circuit 118. The sending circuit 118 generates and outputs a sending signal by performing frequency conversion to the data inputted from the D/A conversion circuit 117.

[0016]the noise detection machine 12 detecting the noise in a transmission line, and frequency conversion being tuned in and carried out and the noise signal received in the receiving circuit 124, After changing into digital data from analog data in the A/D conversion circuit 123, The Fourier transform is carried out by the Fourier conversion circuit 122, it restores to frequency-axis top data, the noise detection circuit 121 detects a noise, and it outputs to the subcarrier priority determining circuit 115 by making the signal level and frequency of a noise into noise information.

[0017]The subcarrier priority determining circuit 115 is provided with the memory circuit (not shown) which memorizes the frequency information which each subcarrier uses, and. The priority of the subcarrier which uses frequency corresponding from the signal level and frequency of the noise inputted from the noise detection machine 12 is judged, and the priority information of each subcarrier is outputted to the mapping control information generating circuit 114.

[0018]The priority of the transmit information into which the mapping control information generating circuit 114 is inputted from the transmit information priority determining circuit 112, The subcarrier priority information inputted from the subcarrier priority determining circuit 115 is matched, and a mapping indication signal with the information to which subcarrier transmit information is arranged is outputted to the mapping circuit 113.

[0019]The subcarrier priority determining circuit 115, It is judged [ which uses the subcarrier which uses frequency corresponding from the signal level and frequency of the noise inputted from the noise detection machine 12 / or or ] whether it is used, A priority is assigned to order with a low signal level of a noise to the subcarrier to be used, Assign a specific priority with the meaning of not using it to the subcarrier which is not used, and it outputs to the mapping control information generating circuit 114 as subcarrier priority information, The mapping control information generating circuit 114 can output a mapping indication signal to the mapping circuit 113 so that transmit information may not be assigned to the subcarrier to which the specific priority with the meaning of not using it was assigned.

[0020]The subcarrier priority determining circuit 115, It is judged [ which uses the subcarrier which uses frequency corresponding from the signal level and frequency of the noise inputted from the noise detection machine 12 / or or ] whether it is used, A priority is assigned to order with a low signal level of a noise to the subcarrier to be used, As a priority is not assigned to the subcarrier which is not used, it outputs to the mapping control information generating circuit 114 as subcarrier priority information, The mapping control information generating circuit 114 can output a mapping indication signal to the mapping circuit 113 so that transmit information may not be assigned to the subcarrier to which the priority is not assigned.

[0021]Assignment of a subcarrier priority may assign a subcarrier priority to the high order of the S/N ratio concerned using the S/N ratio which is a ratio of the level of an input signal and a noise signal.

[0022]The mapping control information generating circuit 114 can output mapping control information to series / parallel conversion circuit 111, and the transmit information priority determining circuit 112 as a part of transmit information.

[0023]In the above-mentioned composition, the operation is explained with reference to drawing 2. Drawing 2 is data on the frequency axis outputted from the Fourier conversion circuit 123, while the signal is not flowing into the transmission line, and it expresses the noise in a transmission line. The priority of each career is determined by whether a value is larger than two or more thresholds L1, L2, L3, and L4, as the subcarrier priority determining circuit 115 shows drawing 3 this information to the signal level of a noise, or small. The priority over each subcarrier assigned by this becomes like drawing 4, and is assigned to order with a high priority with A, B, C, and D. Here, the priority D has the meaning that the subcarrier which uses the frequency band does not use it.

[0024]The speech information for talking between control information required in order to transmit and receive as transmit information, the transmitting side, and a receiver, There is file transfer information between computers, even when information is mistaken, it supposes that a priority is high in the order of the control information and speech information which are not allowed resending, and the file transfer information allowed resending, and it is considered as the priority A, the priority B, and the priority C at order.

[0025]As the mapping control information generating circuit 114 makes these subcarrier priority and a transmit information priority correspond, respectively, it creates a mapping indication signal, and it outputs it to the mapping circuit 113. Transmit information is arranged like Drawing 5 by the mapping circuit 113 where the information was inputted at each career.

[0026]Thereby, a priority is high, i.e., the control information and speech information which are the transmit information which should not be allowed resending but, to which information should be transmitted correctly will be transmitted using the subcarrier of a zone with a low signal level of a noise, and it becomes possible to improve the reliability of information.

[0027]Drawing 6 is a block diagram showing the composition of the multi carrier receiver which is one embodiment of this invention.

[0028]in the multi carrier receiver 61 -- the receiving circuit 611 -- an input signal -- a channel selection -- and frequency conversion is carried out and it outputs to the A/D conversion circuit 612. The A/D conversion circuit 612 changes the inputted analog data into digital data, and outputs them to the Fourier conversion circuit 613. The Fourier conversion circuit 613 carries out the Fourier transform of the input data, restores to frequency-axis top data, and outputs it to the mapping control information acquisition circuit 614 and the demapping circuit 615. The mapping control information acquisition circuit 614 acquires mapping control information from the data to which it restored by the Fourier conversion circuit 613, and memorizes mapping information to a memory circuit (not shown), and it is outputted as a demapping indication signal to the demapping circuit 615. The demapping circuit 615 arranges demodulated data to parallel data with a demapping indication signal, and outputs it to the parallel/serial-conversion circuit 616. The parallel/serial-conversion circuit 616 changes the inputted parallel data into serial data, and outputs it as receipt information.

[0029]

[Effect of the Invention]As mentioned above, the multi carrier transmitter of this invention and a receiver are performing career arrangement according to the noise level of a transmission line, when transmitting several information that priorities differ, as transmit information, The multi carrier transmitter and receiver which can raise the reliability of the information to order with a high priority of transmit information can be obtained.

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## TECHNICAL FIELD

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[Field of the Invention]This invention relates to the multi carrier transmitter and receiver which are one of the information data transmission systems.

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## PRIOR ART

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[Description of the Prior Art] In recent years, in wire communications, such as radio, such as digital sound broadcast and digital television broadcasting, or a pair wire, the multi-carrier transmission method attracts attention. A multi-carrier transmission method transmits by dividing information into two or more careers.

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## EFFECT OF THE INVENTION

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## TECHNICAL PROBLEM

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## MEANS

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[0023]In the above-mentioned composition, the operation is explained with reference to drawing 2. Drawing 2 is data on the frequency axis outputted from the Fourier conversion circuit 123, while the signal is not flowing into the transmission line, and it expresses the noise in a transmission line. The priority of each career is determined by whether a value is larger than two or more thresholds L1, L2, L3, and L4, as the subcarrier priority determining circuit 115 shows drawing 3 this information to the signal level of a noise, or small. The priority over each subcarrier assigned by this becomes like drawing 4, and is assigned to order with a high priority with A, B, C, and D. Here, the priority D has the meaning that the subcarrier which uses the frequency band does not use it.

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[0025]As the mapping control information generating circuit 114 makes these subcarrier priority and a transmit information priority correspond, respectively, it creates a mapping indication signal, and it outputs it to the mapping circuit 113. Transmit information is arranged like drawing 5 by the mapping circuit 113 where the information was inputted at each career.

[0026]Thereby, a priority is high, i.e., the control information and speech information which are the transmit information which should not be allowed resending but, to which information should be transmitted correctly will be transmitted using the subcarrier of a zone with a low signal level of a noise, and it becomes possible to improve the reliability of information.

[0027]Drawing 6 is a block diagram showing the composition of the multi carrier

receiver which is one embodiment of this invention.

[0028]in the multi carrier receiver 61 -- the receiving circuit 611 -- an input signal -- a channel selection -- and frequency conversion is carried out and it outputs to the A/D conversion circuit 612. The A/D conversion circuit 612 changes the inputted analog data into digital data, and outputs them to the Fourier conversion circuit 613. The Fourier conversion circuit 613 carries out the Fourier transform of the input data, restores to frequency-axis top data, and outputs it to the mapping control information acquisition circuit 614 and the demapping circuit 615. The mapping control information acquisition circuit 614 acquires mapping control information from the data to which it restored by the Fourier conversion circuit 613, and memorizes mapping information to a memory circuit (not shown), and it is outputted as a demapping indication signal to the demapping circuit 615. The demapping circuit 615 arranges demodulated data to parallel data with a demapping indication signal, and outputs it to the parallel/serial-conversion circuit 616. The parallel/serial-conversion circuit 616 changes the inputted parallel data into serial data, and outputs it as receipt information.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The block diagram showing the composition of one embodiment of the multi carrier transmitter concerning this invention

[Drawing 2]The frequency-spectra figure of a noise [ in / on the embodiment in drawing 1, and / a transmission line ]

[Drawing 3]The frequency-spectra figure for explaining how to judge the level of the noise in a transmission line, in the embodiment in drawing 1

[Drawing 4]The frequency-spectra figure for explaining how to assign the priority of each subcarrier in the embodiment in drawing 1

[Drawing 5]The frequency-spectra figure for explaining how to arrange transmit information in the embodiment in drawing 1

[Drawing 6]The block diagram showing the composition of one embodiment of the multi carrier receiver concerning this invention

[Drawing 7]The block diagram showing the composition of the conventional multi carrier transmitter

[Drawing 8]The block diagram showing the composition of the conventional multi carrier receiver

[Drawing 9]The frequency-spectra figure for explaining the career arrangement in the conventional multi carrier transmitter in drawing 7

[Description of Notations]

11 Multi carrier transmitter

12 Noise detection machine

111 Series/parallel conversion circuit

112 Transmit information priority determining circuit

113 Mapping circuit

114 Mapping control information generating circuit

115 Subcarrier priority determining circuit

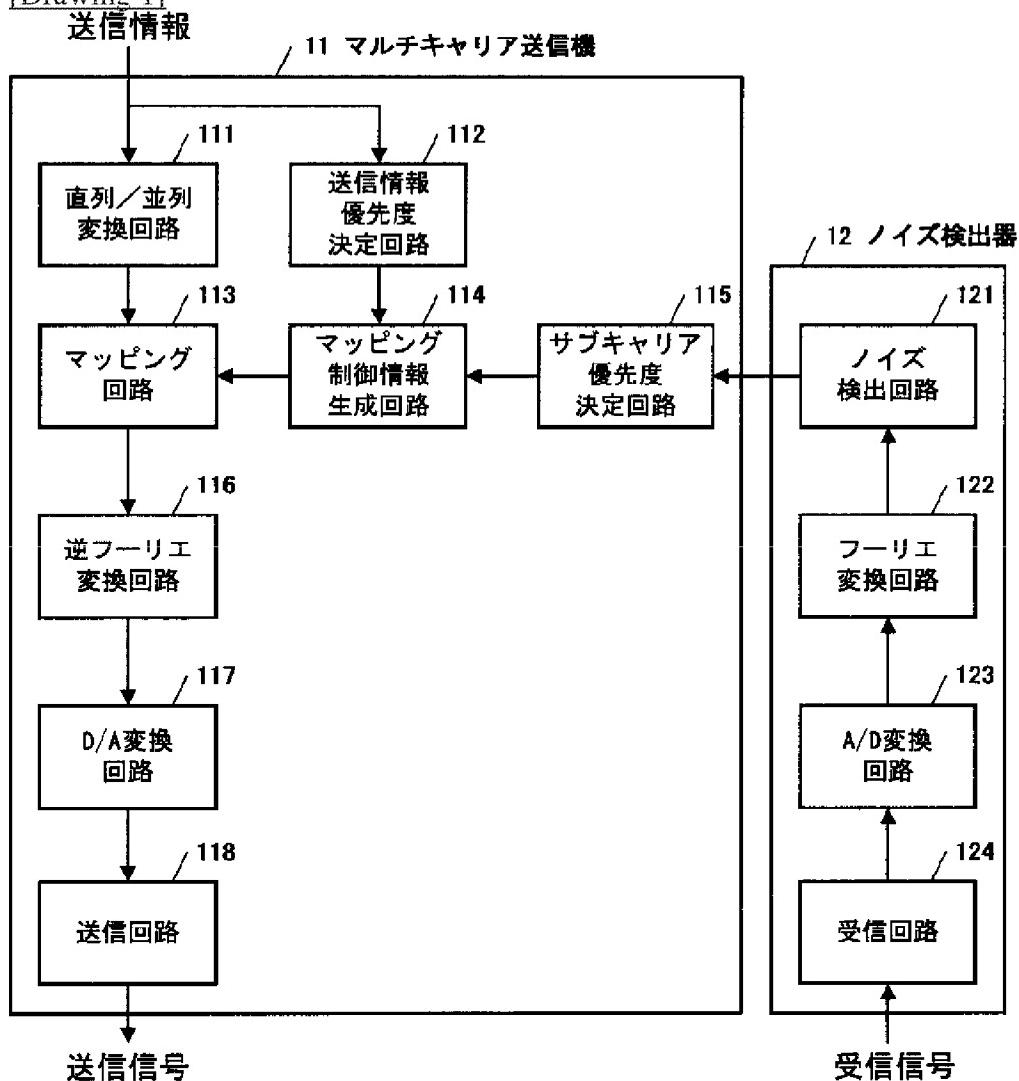
- 116 Inverse FOURIER transform circuit
- 117 D/A conversion circuit
- 118 Sending circuit
- 121 Noise detection circuit
- 122 Fourier conversion circuit
- 123 A/D conversion circuit
- 124 Receiving circuit
- 61 Multi carrier receiver
- 611 Receiving circuit
- 612 A/D conversion circuit
- 613 Fourier conversion circuit
- 614 Mapping control information acquisition circuit
- 615 Demapping circuit
- 616 Parallel/serial-conversion circuit
- 71 Series/parallel conversion circuit
- 72 Mapping circuit
- 73 Inverse FOURIER transform circuit
- 74 D/A conversion circuit
- 75 Sending circuit
- 81 Receiving circuit
- 82 A/D conversion circuit
- 83 Fourier conversion circuit
- 84 Demapping circuit
- 85 Parallel/serial-conversion circuit

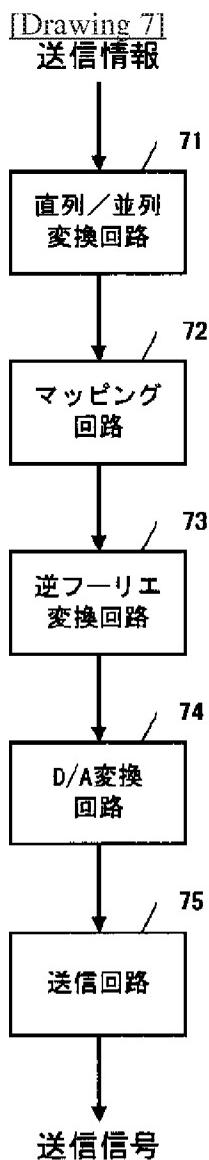
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**DRAWINGS**

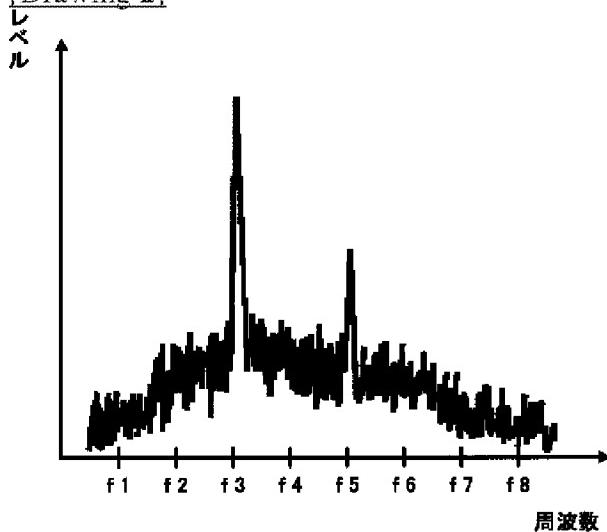
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[Drawing 1]

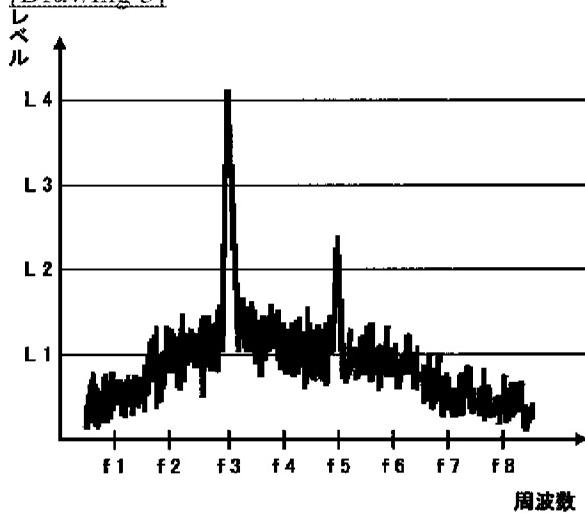




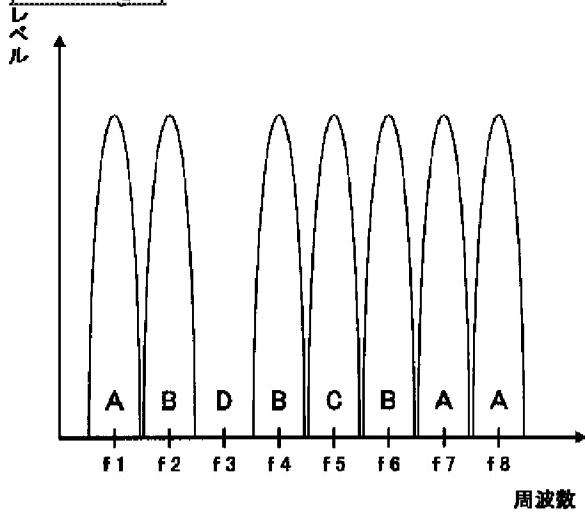
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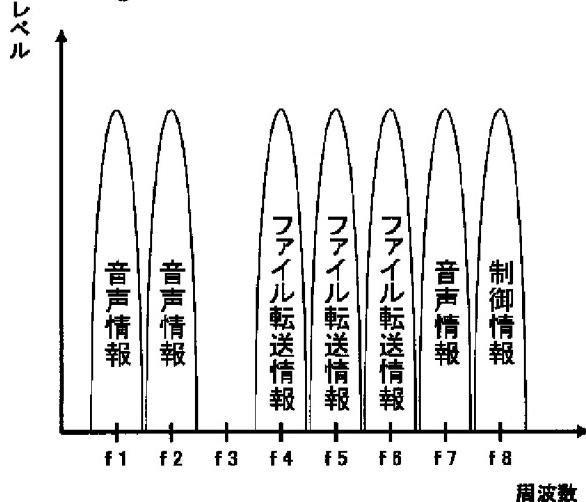
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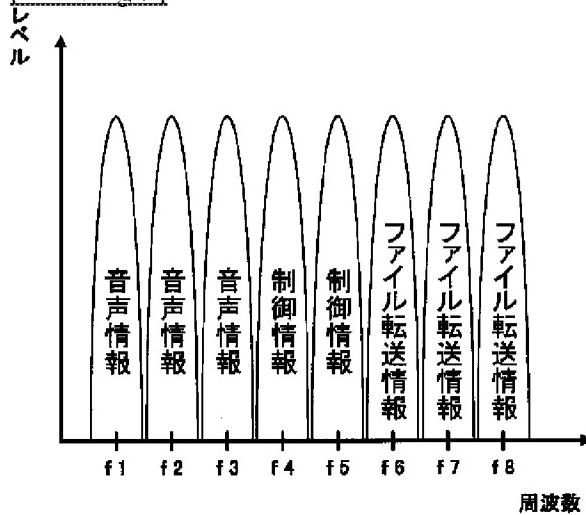
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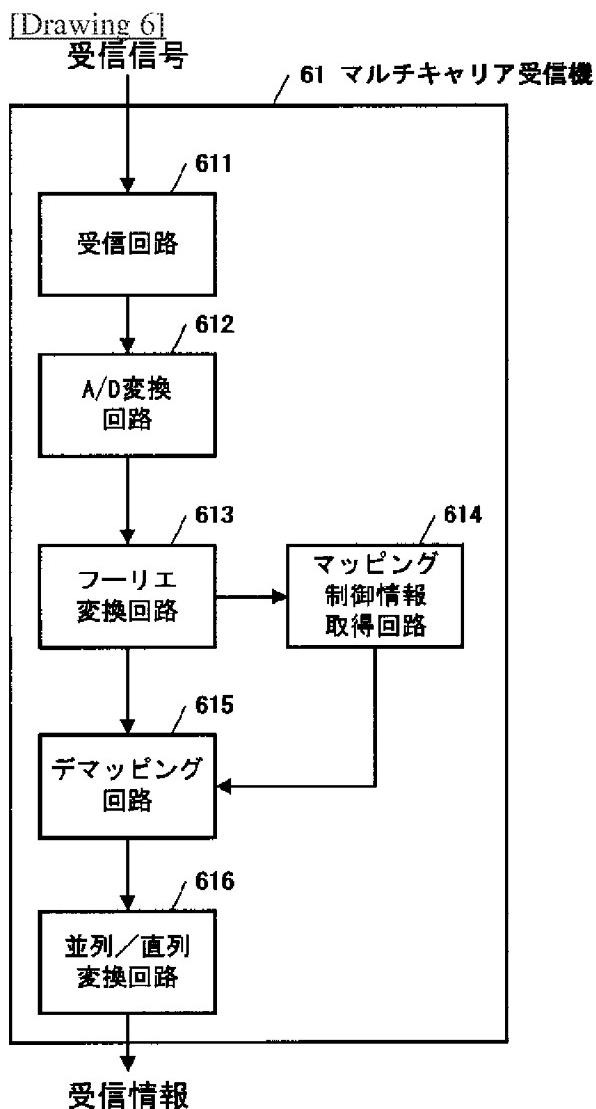


[Drawing 5]



[Drawing 9]





## [Drawing 8]

受信信号

↓

81

受信回路

↓

82

A/D変換  
回路

↓

83

フーリエ  
変換回路

↓

84

デマッピング  
回路

↓

85

並列／直列  
変換回路

↓

受信情報

(19)日本国特許庁 (JP)

(12) 公開特許公報 (A)

(11)特許出願公開番号

特開2001-168821

(P2001-168821A)

(43)公開日 平成13年6月22日(2001.6.22)

(51)Int.Cl.<sup>7</sup>  
H 0 4 J 1/02  
11/00

識別記号

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H 0 4 J 1/02  
11/00

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5 K 0 2 2  
Z

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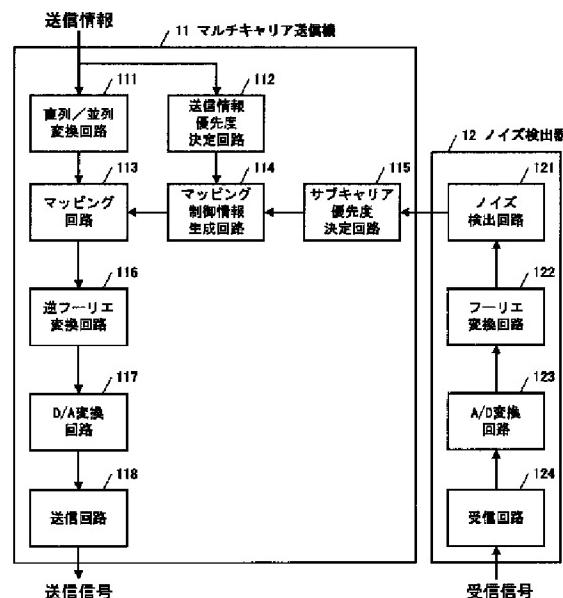
最終頁に続く

(54)【発明の名称】 マルチキャリア送信機及び受信機

(57)【要約】

【課題】 従来のマルチキャリア伝送方式では優先度の高い伝送情報をノイズレベルの高い周波数のキャリアに配置することがある。

【解決手段】 伝送路におけるノイズをノイズ検出器12により検出、その結果に基づいて使用するサブキャリアの優先度をサブキャリア優先度決定回路115により決定し、マッピング制御情報生成回路114によりそのサブキャリア優先度と送信情報の優先度を対応付けるようにマッピング回路113に指示を出すことで、キャリア配置を変化させる。



## 【特許請求の範囲】

【請求項1】 優先度が割り当てられて入力される複数の送信情報と、  
伝送路から複数の周波数帯域ごとのノイズレベルを検出するノイズ情報取得手段と、  
前記ノイズ情報取得手段により検出されるノイズレベルが低い周波数帯域順に、  
前記優先度が高い順の送信情報を割り当て、キャリア発生して伝送路に出力するマルチキャリア信号発生手段とを具備することを特徴とするマルチキャリア送信機。

【請求項2】 前記マルチキャリア信号発生手段は、前記ノイズ情報取得手段により検出されるノイズレベルが传送に不適と判定された場合、前記ノイズレベルが検出された周波数帯域には前記送信情報を割り当てないようにすることを特徴とする請求項1記載のマルチキャリア送信機。

【請求項3】 前記マルチキャリア信号発生手段は、前記複数の送信情報をどの周波数帯域に割り当てたかというマッピング情報を送信情報として特定の周波数帯域に割り当て、キャリア発生して伝送路に出力することを特徴とする請求項1又は請求項2記載のマルチキャリア送信機。

【請求項4】 請求項3に記載のマルチキャリア送信機により送信されたマルチキャリア信号を受信し復調するマルチキャリア信号復調手段と、  
前記マルチキャリア信号復調手段から前記マッピング情報を抽出し、その情報に従って複数の受信情報を抽出することを特徴とするマルチキャリア受信機。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、情報データ伝送方式の1つであるマルチキャリア送信機と受信機に関する。

## 【0002】

【従来の技術】近年、デジタル音声放送やデジタルテレビ放送などの無線通信、またはペア線などの有線通信においてマルチキャリア伝送方式が注目されている。マルチキャリア伝送方式とは情報を複数のキャリアに分割して送信を行うものである。

【0003】従来のマルチキャリア送信機の例を図7に示す。図7において、送信情報は直列／並列変換器71に入力される。この直列／並列変換器71は入力データを直列データから並列データに変換して出力するものである。その並列データはマッピング回路72に入力され、キャリア周波数と振幅、位相の割り当てを行う。このマッピング回路72から出力されるデータを逆フーリエ変換回路73で逆フーリエ変換し、D/A変換回路74でデジタルデータからアナログデータに変換し、送信回路75により周波数変換を行う。

【0004】また、従来のマルチキャリア受信機の例を

図8に示す。図8において、受信回路81により受信信号を周波数変換する。そのデータをA/D変換回路82でデジタルデータに変換し、フーリエ変換回路83でフーリエ変換した後、デミッシング回路84により並べ替えを行い、並列／直列変換器85により直列データに変換し、受信情報として出力する。

【0005】従来のマルチキャリア伝送方式において、複数の情報を送信する場合、あらかじめ決められたサブキャリアに情報を配置していた。図9において、例えば

10 8チャネルのサブキャリアを使用して、送信側と受信側間で会話をするための音声情報、送受信を行なうために必要な制御情報、コンピュータ間のファイル転送情報を送信情報として伝送する場合、音声情報を周波数f1からf3に、制御情報を周波数f4とf5に、ファイル転送情報を周波数f6からf8のチャネルのキャリアに分配して送信を行う。この場合、制御情報と音声情報は情報が誤っている場合でも情報の再送が許されない優先度が高い送信情報であり、ファイル転送情報は情報が誤った場合でも情報の再送が許されるため優先度が低い送信情報である。

【0006】このとき、伝送路において図2のようなノイズが存在したとすると、周波数f3とf5辺りにレベルの大きいノイズがあるため、周波数f3を使用する音声聞きとなり信号品質が大きく劣化してしまう。また、有線通信においては、周波数f3やf5のようなレベルの大きいノイズは放送波である場合が多く、時刻、天候、場所などの様々な要因に作用され、その周波数とレベルが変動する。

## 【0007】

30 【発明が解決しようとする課題】以上に述べたように、従来のマルチキャリア伝送方式において、複数の情報を送信情報として伝送する場合、あらかじめ決められたサブキャリアに情報を配置していた。そのため送信する情報の中で、優先度の高い送信情報がノイズレベルの高い周波数のキャリアに配置された場合、情報の信頼度が低下してしまう。また、伝送路が地上波からの干渉を受ける場合、ノイズレベルは時間、天候、場所などの要因に左右されるため、固定的にキャリア配置を行うマルチキャリア伝送では、これらの常に変化する要因に対して適応的に対応することができないという課題があった。

【0008】本発明の目的は、送信情報の優先度と伝送路のノイズレベルに応じてキャリア配置を行うことで、送信情報の優先度が高い順にその情報の信頼度を高めることができるマルチキャリア送信機及び受信機を提供することである。

## 【0009】

【課題を解決するための手段】上記の問題を解決するために本発明は、以下に示す特徴的構成手段を採用する。

【0010】(1) この発明に係るマルチキャリア送信機は、優先度が割り当てられて入力される複数の送信情

報と、伝送路から複数の周波数帯域ごとのノイズレベルを検出するノイズ情報取得手段と、そのノイズ情報取得手段により検出されるノイズレベルが低い周波数帯域順に、優先度が高い順の送信情報を割り当て、キャリア発生して伝送路に出力するマルチキャリア信号発生手段を具備することを特徴とする。

【0011】(2)(1)の構成において、前記マルチキャリア信号発生手段は、前記ノイズ情報取得手段により検出されるノイズレベルが伝送に不適と判定された場合、前記ノイズレベルが検出された周波数帯域には前記送信情報を割り当てないようすることを特徴とする。

【0012】(3)(1)および(2)の構成において、前記マルチキャリア信号発生手段は、前記複数の送信情報をどの周波数帯域に割り当てたかというマッピング情報を送信情報として特定の周波数帯域に割り当て、キャリア発生して伝送路に出力することを特徴とする。

【0013】(4)この発明に係るマルチキャリア受信機は、(3)の構成におけるマルチキャリア送信機により送信されたマルチキャリア信号を受信し復調を行い、復調されたデータから前記マッピング情報を抽出し、その情報に従って複数の受信情報を抽出することを特徴とする。

#### 【0014】

【発明の実施の形態】以下、本発明の実施の形態について図面を参考しながら説明する。図1は本発明の一実施形態であるマルチキャリア送信機の構成を示すブロック図である。

【0015】マルチキャリア送信機11において、優先度を情報に含む複数の送信情報が送信情報優先度決定回路112と直列／並列変換回路111に入力される。この送信情報優先度決定回路112は送信情報に含まれる優先度を抽出し、抽出された送信情報の優先度はマッピング制御情報生成回路114に出力される。直列／並列変換回路111は入力データを直列データから並列データに変換するもので、その並列データはマッピング回路113に出力される。マッピング回路113はマッピング制御情報生成回路114からのマッピング指示信号により、入力データを指示されたサブキャリアに配置し、逆フーリエ変換回路116に出力する機能を有する。逆フーリエ変換回路116はマッピング回路113から入力されるデータを逆フーリエ変換することによりマルチキャリア信号を生成しD/A変換回路117に出力する。D/A変換回路117は逆フーリエ変換回路116から入力されるマルチキャリア信号をデジタルデータからアナログデータに変換し、送信回路118に対して出力する。送信回路118はD/A変換回路117から入力されるデータに対して周波数変換を行うことで送信信号を生成し出力する。

【0016】ノイズ検出器12は伝送路におけるノイズを検出するもので、受信回路124で受信したノイズ信

号を選局および周波数変換し、A/D変換回路123でアナログデータからデジタルデータに変換した後、フーリエ変換回路122でフーリエ変換して周波数軸上データを復調し、ノイズ検出回路121によりノイズを検出し、ノイズの信号レベルと周波数をノイズ情報としてサブキャリア優先度決定回路115に出力する。

【0017】サブキャリア優先度決定回路115は各サブキャリアが使用する周波数情報を記憶するメモリ回路(図示せず)を備えると共に、ノイズ検出器12から入力されたノイズの信号レベルと周波数から対応する周波数を使用するサブキャリアの優先度を判定し各サブキャリアの優先度情報をマッピング制御情報生成回路114に出力する。

【0018】マッピング制御情報生成回路114は送信情報優先度決定回路112から入力される送信情報の優先度と、サブキャリア優先度決定回路115から入力されるサブキャリア優先度情報を対応付け、送信情報をどのサブキャリアに配置するかという情報を持つマッピング指示信号をマッピング回路113に対して出力する。

【0019】なお、サブキャリア優先度決定回路115は、ノイズ検出器12から入力されたノイズの信号レベルと周波数から対応する周波数を使用するサブキャリアを使用するか使用しないかを判定し、使用するサブキャリアに対してはノイズの信号レベルが低い順に優先度を割り当て、使用しないサブキャリアに対しては使用しないという意味を持つ特定の優先度を割り当ててサブキャリア優先度情報をマッピング制御情報生成回路114に対して出力し、マッピング制御情報生成回路114は使用しないという意味を持つ特定の優先度が割り当てられたサブキャリアに対しては送信情報を割り当てないようにマッピング指示信号をマッピング回路113に対して出力することが可能である。

【0020】また、サブキャリア優先度決定回路115は、ノイズ検出器12から入力されたノイズの信号レベルと周波数から対応する周波数を使用するサブキャリアを使用するか使用しないかを判定し、使用するサブキャリアに対してはノイズの信号レベルが低い順に優先度を割り当て、使用しないサブキャリアに対しては優先度を割り当てないようにしてサブキャリア優先度情報をマッピング制御情報生成回路114に対して出力し、マッピング制御情報生成回路114は優先度が割り当てられていないサブキャリアに対しては送信情報を割り当てないようにマッピング指示信号をマッピング回路113に対して出力することが可能である。

【0021】また、サブキャリア優先度の割り当ては、受信信号とノイズ信号のレベルの比であるS/N比を用い、当該S/N比の高い順にサブキャリア優先度を割り当てても良い。

【0022】また、マッピング制御情報生成回路114

はマッピング制御情報を送信情報の一部として直列／並列変換回路111および送信情報優先度決定回路112に対して出力することが可能である。

【0023】上記構成において、図2を参照してその作用について説明する。図2は伝送路に信号が流れていないう時にフーリエ変換回路123から出力される周波数軸上のデータであり、伝送路におけるノイズを表している。この情報をサブキャリア優先度決定回路115はノイズの信号レベルに対し、図3に示すように複数のしきい値L1、L2、L3、L4より値が大きいか小さいかで各キャリアの優先度を決定する。これにより割り当てられた各サブキャリアに対する優先度は図4のようになり、優先度が高い順にA、B、C、Dと割り当てる。ここで、優先度Dはその周波数帯域を使用するサブキャリアは使用しないという意味を持つ。

【0024】また、送信情報としては送受信を行うために必要な制御情報、送信側と受信側間で会話をするための音声情報、コンピュータ間のファイル転送情報があり、情報が誤った場合でも再送が許されない制御情報、音声情報、再送が許されるファイル転送情報の順で優先度が高いとし、順に優先度A、優先度B、優先度Cとする。

【0025】マッピング制御情報生成回路114はこれらサブキャリア優先度と送信情報優先度をそれぞれ対応させるようにしてマッピング指示信号を作成し、マッピング回路113に対して出力する。その情報が入力されたマッピング回路113により送信情報は図5のように各キャリアに配置される。

【0026】これにより、優先度が高い、すなわち再送が許されず情報が正確に伝送されるべき送信情報である制御情報、音声情報はノイズの信号レベルが低い帯域のサブキャリアを使用して送信されることとなり、情報の信頼性を高めることができる。

【0027】図6は本発明の一実施形態であるマルチキャリア受信機の構成を示すブロック図である。

【0028】マルチキャリア受信機61において、受信回路611は受信信号を選局および周波数変換し、A/D変換回路612に出力する。A/D変換回路612は入力されたアナログデータをデジタルデータに変換し、フーリエ変換回路613に出力する。フーリエ変換回路613は入力データをフーリエ変換して周波数軸上データを復調し、マッピング制御情報取得回路614とデマッピング回路615に出力する。マッピング制御情報取得回路614はフーリエ変換回路613により復調されたデータからマッピング制御情報を取得し、メモリ回路（図示せず）にマッピング情報を記憶すると共に、デマッピング回路615に対しデマッピング指示信号として出力する。デマッピング回路615はデマッピング指示信号により復調データを並列データに配置し、並列／直列変換回路616に出力する。並列／直列変換回路61

6は入力された並列データを直列データに変換して、受信情報として出力する。

#### 【0029】

【発明の効果】以上のように、本発明のマルチキャリア送信機、受信機は優先度の異なる複数の情報を送信情報として伝送する場合、伝送路のノイズレベルに応じてキャリア配置を行うことで、送信情報の優先度が高い順にその情報の信頼度を高めることができるマルチキャリア送信機、受信機を得ることができる。

#### 10 【図面の簡単な説明】

【図1】本発明に係るマルチキャリア送信機の一実施形態の構成を示すブロック図

【図2】図1における実施形態において、伝送路におけるノイズの周波数スペクトラム図

【図3】図1における実施形態において、伝送路におけるノイズのレベルを判定する方法を説明するための周波数スペクトラム図

【図4】図1における実施形態において、各サブキャリアの優先度を割り当てる方法を説明するための周波数スペクトラム図

【図5】図1における実施形態において、送信情報を配置する方法を説明するための周波数スペクトラム図

【図6】本発明に係るマルチキャリア受信機の一実施形態の構成を示すブロック図

【図7】従来のマルチキャリア送信機の構成を示すブロック図

【図8】従来のマルチキャリア受信機の構成を示すブロック図

【図9】図7における従来のマルチキャリア送信機におけるキャリア配置を説明するための周波数スペクトラム図

#### 30 【符号の説明】

11 マルチキャリア送信機

12 ノイズ検出器

111 直列／並列変換回路

112 送信情報優先度決定回路

113 マッピング回路

114 マッピング制御情報生成回路

115 サブキャリア優先度決定回路

116 逆フーリエ変換回路

117 D/A変換回路

118 送信回路

121 ノイズ検出回路

122 フーリエ変換回路

123 A/D変換回路

124 受信回路

61 マルチキャリア受信機

611 受信回路

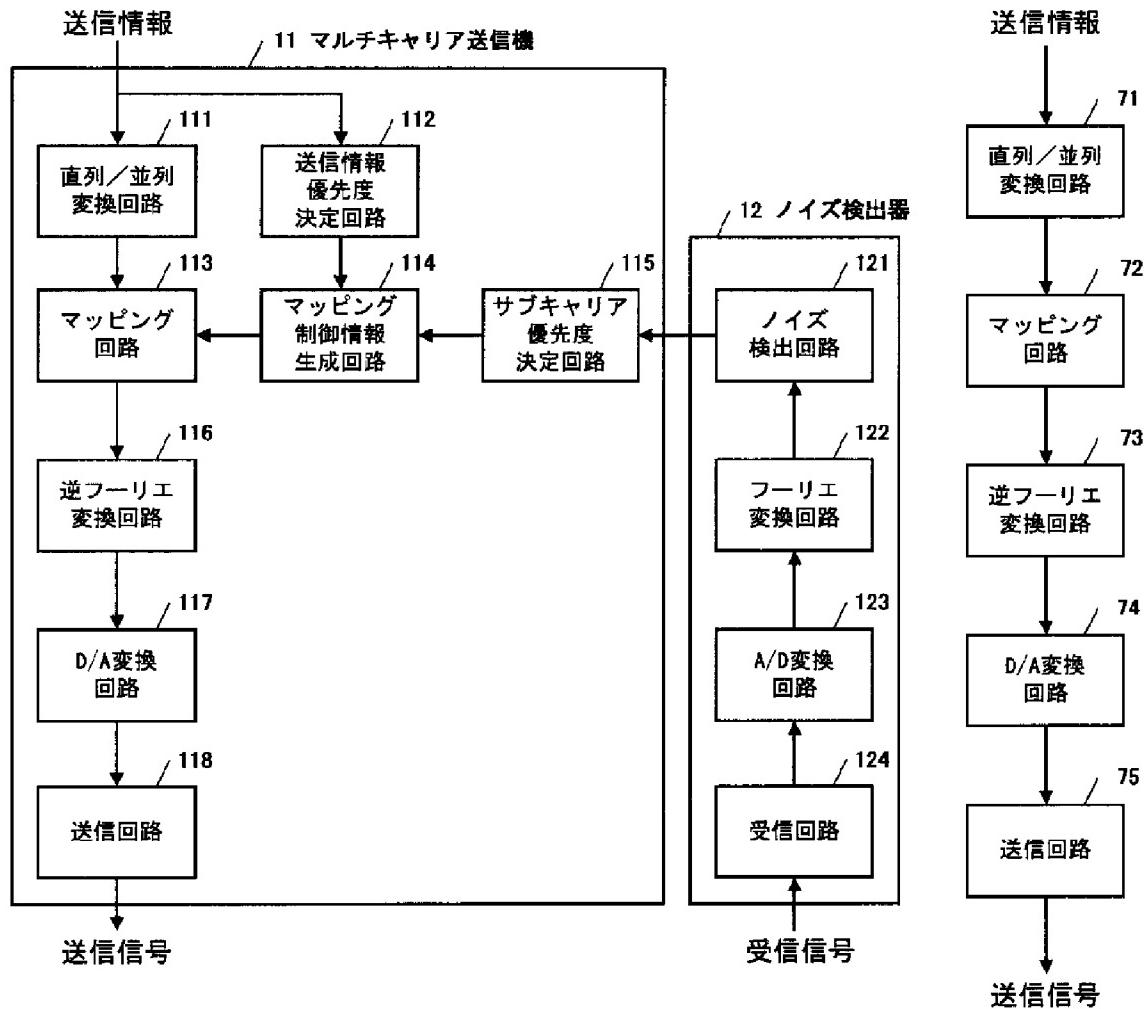
612 A/D変換回路

50 613 フーリエ変換回路

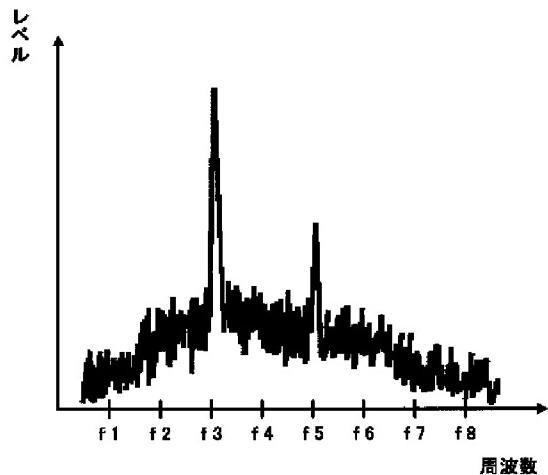
- 614 マッピング制御情報取得回路  
 615 デマッピング回路  
 616 並列／直列変換回路  
 71 直列／並列変換回路  
 72 マッピング回路  
 73 逆フーリエ変換回路  
 74 D/A変換回路

- 75 送信回路  
 81 受信回路  
 82 A/D変換回路  
 83 フーリエ変換回路  
 84 デマッピング回路  
 85 並列／直列変換回路

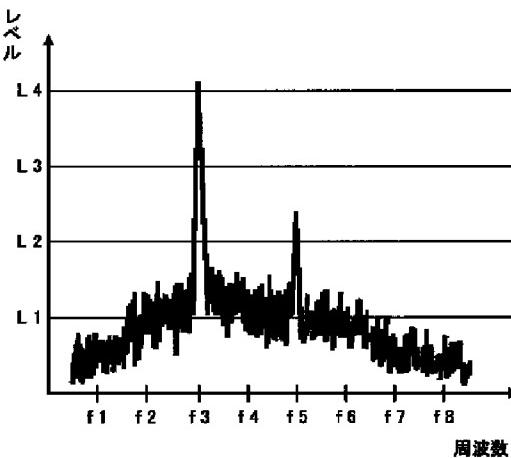
【図1】



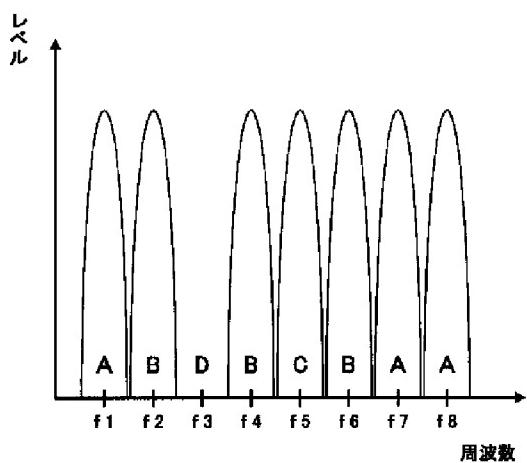
【図2】



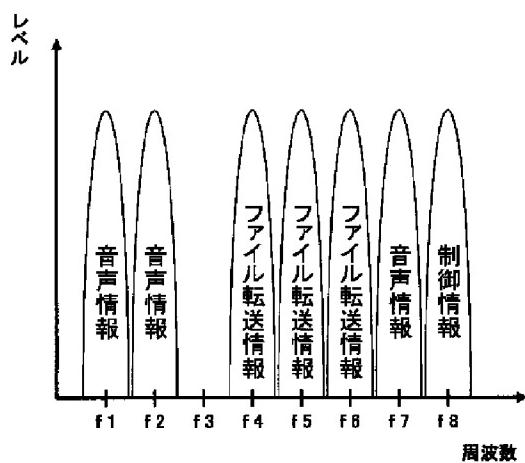
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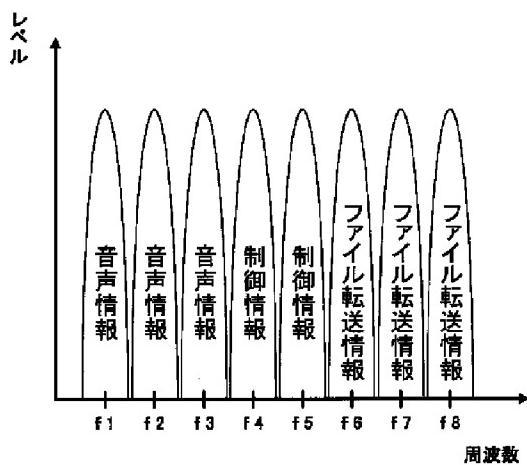
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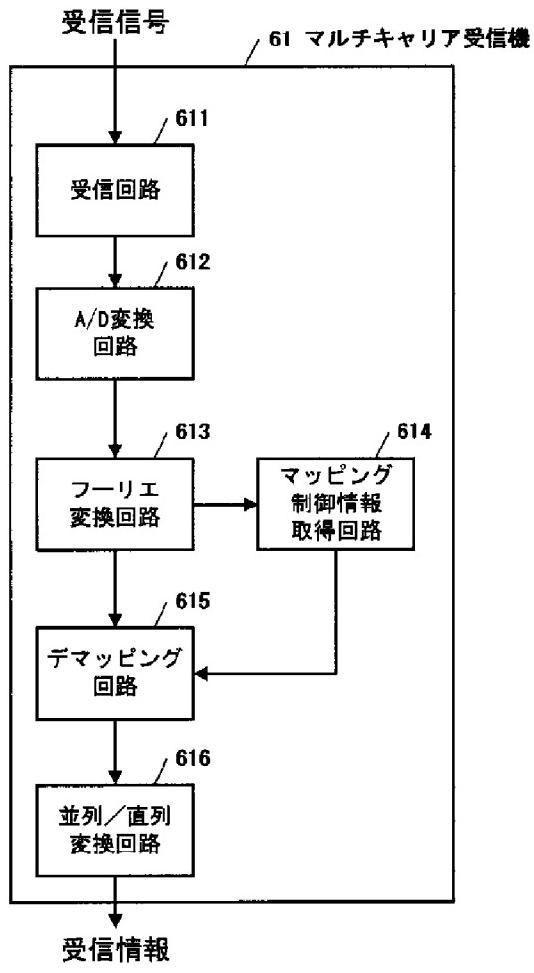
【図5】



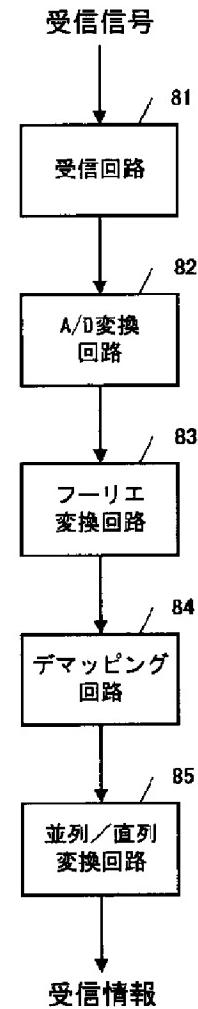
【図9】



【図6】



【図8】



フロントページの続き

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